Atrial Fibrillation

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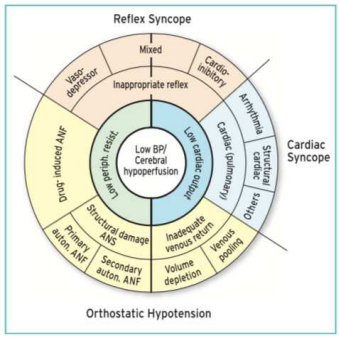
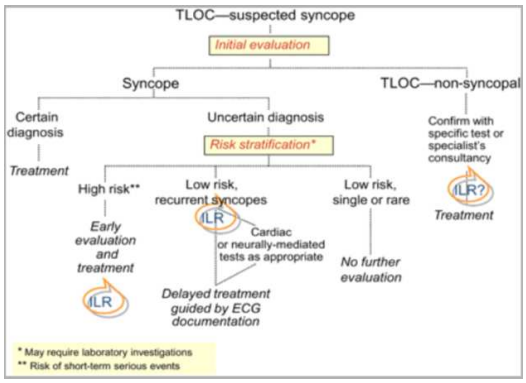
Syncope



Electrocardiographic monitoring recommended by ESC

Recommendations	Class[a]	Level[b]
Indications		
Immediate in-hospital monitoring (in bed or by telemetry) is indicated in high-risk patients (defined in *Table 6*).	I	C
Holter monitoring should be considered in patients who have frequent syncope or presyncope (≥1 episode per week).[161]	IIa	B
External loop recorders should be considered, early after the index event, in patients who have an inter-symptom interval ≤4 weeks.[162,166,168,201]	IIa	B
ILR is indicated in an early phase of evaluation in patients with recurrent syncope of uncertain origin, absence of high-risk criteria (listed in *Table 6*), and a high likelihood of recurrence within the battery life of the device.[175,176,181–184,201] *Supplementary Data Table 5*	I	A
ILR is indicated in patients with high-risk criteria (listed in *Table 6*) in whom a comprehensive evaluation did not demonstrate a cause of syncope or lead to a specific treatment, and who do not have conventional indications for primary prevention ICD or pacemaker indication.[174,180,187,188,191] *Supplementary Data Tables 5 and 6*	I	A
ILR should be considered in patients with suspected or certain reflex syncope presenting with frequent or severe syncopal episodes.[184–186]	IIa	B
ILR may be considered in patients in whom epilepsy was suspected but the treatment has proven ineffective.[137,189–191] *Supplementary Data Table 7*	IIb	B
ILR may be considered in patients with unexplained falls.[191–194] *Supplementary Data Table 8*	IIb	B
Diagnostic criteria		
Arrhythmic syncope is confirmed when a correlation between syncope and an arrhythmia (bradyarrhythmia or tachyarrhythmia) is detected.[172,184–186,188,200]	I	B
In the absence of syncope, arrhythmic syncope should be considered likely when periods of Mobitz II second- or third-degree AV block or a ventricular pause >3 s (with the possible exception of young trained persons, during sleep or rate-controlled atrial fibrillation), or rapid prolonged paroxysmal SVT or VT are detected.[185,188,197–199]	IIa	C

EHRA consensus statement on implantable and external ECG monitors (Europace 2009)



Evidence for ILR

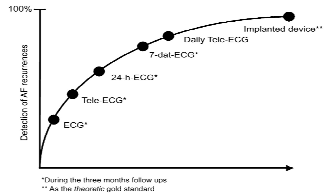
- In pooled data from nine studies n 506 patients with unexplained syncope at the end of complete negative work-up, a correlation between syncope and ECG monitoring was found in 176 patients (35%)
- At the time of the recorded event
  - 56% had asystole or bradycardia
  - 11% had tachycardia
  - 33% had no arrhythmia

Clinical Indications for ILRs

- Diagnosis and treatment of transient loss of consciousness or Syncope "to obtain a correlation between ECG findings and syncope relapse"
- In high-risk patients in whom a comprehensive evaluation did not demonstrate a cause of syncope
- To assess the contribution of bradycardia before embarking on cardiac pacing (in suspected neurally mediated syncope)
- Uncertain syncope origin in order to definitely exclude an arrhythmic mechanism
- Recurrent history of unexplained palpitations associated with hemodynamic impairment (symptoms) when all other tests result inconclusive or symptoms occur on long intervals
- Unexplained aetiology for strokes

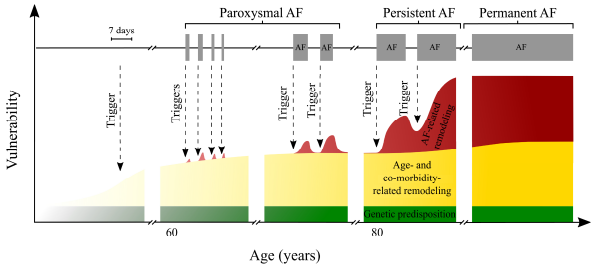
ILR is considered the golden standard tool for AF detection

- Atrial fibrillation: detection and therapy
- AF is significantly under detected by intermittent monitoring systems



Arya, A et al. Clinical implications of various follow up strategies after catheter ablation of atrial fibrillation, *Pacing Clin Electrophysiol*, 2007, vol. 30 (pg. 458-62)

Progression of atrial fibrillation



Chang et al PLoS ONE 11(4): e0152349.

CARISMA trial

- 1393 patients who received an ILR within 11±5 days of an acute MI
- A significant bradyarrhythmia or tachyarrhythmia was documented in 46% of patients.
- Atrioventricular (AV) block was the most potent predictor of mortality.
- **28% incidence of new-onset AF**

P E B Thomsen, et. al. The Cardiac Arrhythmias and Risk Stratification After Acute Myocardial Infarction (CARISMA) Study. *Circulation*. 2010. 122:1258-1264.

Incidence of A Fib detected by ILRs in cryptogenic stroke

- Aged from 17 to 73 (median 52) years
- 51 patients in whom ILRs were implanted for the investigation of ischemic stroke
- No cause had been found (cryptogenic)
- The median (range) of monitoring prior to AF detection was 48 (0–154) days.
- **AF was detected by ILR in 25.5%**

P E. Cotter, et al. **Neurology. 2013 Apr 23; 80(17): 1546–1550.**

CRYSTAL AF

Atrial fibrillation (AF) in cryptogenic stroke (CS) or transient ischemic attack (TIA)

221 patients randomized to ILR

29 patients within 12 months (13 %)

42 patients at 36 months (19 %)

Vincent N. Thijs, et al. Predictors for atrial fibrillation detection after cryptogenic stroke Results from CRYSTAL AF. Neurology 2016, Jan 19; 86(3): 261-269

EHRA CONSENSUS

- Atrial high rate event (AHRE): rate >190 beats/min detected by cardiac implantable electronic devices.
- Subclinical atrial fibrillaton (AF): atrial high-rate episodes (>6 minutes and <24-hours) with lack of correlated symptoms

Summary of studies on atrial fibrillation detected by CIEDs and thromboembolic risk

Year	Trial	Number of patients	Duration of follow-up	Atrial rate cut-off	AF burden threshold	Hazard ratio for TE event	TE event rate (below vs. above AF burden threshold)
2003	Ancillary MOST[5]	312	27 months (median)	>220 bpm	5 min	6.7 (*P*=0.020)	3.2% overall (1.3% vs. 5%)
2005	Italian AT500 Registry[18]	725	22 months (median)	>174 bpm	24 h	3.1 (*P*=0.044)	1.2% annual rate
2009	Botto et al[19]	568	1 year (mean)	>174 bpm	$CHADS_2$+AF burden	n/a	2.5% overall (0.8% vs. 5%)
2009	TRENDS[20]	2486	1.4 years (mean)	>175 bpm	5.5 h	2.2 (*P*=0.060)	1.2% overall (1.1% vs. 2.4%)
2012	Home Monitor CRT[22]	560	370 days (median)	>180 bpm	3.8 h	9.4 (*P*=0.006)	2.0% overall
2012	ASSERT[7]	2580	2.5 years (mean)	>190 bpm	6 min	2.5 (*P*=0.007)	(0.69% vs. 1.69%)
2014	SOS AF[23]	10016	2 years (median)	>175 bpm	1 h	2.11 (*P*=0.008)	0.39% per year Overall

EHRA CONSENSUS

Summary of key studies examining the utility of monitoring for the detection of previously undetected atrial fibrillation

Study (Year)	Design (number)	Monitoring device	Population	Definition of AF	Prevalence of AF
EMBRACE[48] (2014)	RCT (286 with monitor vs. 285 with Holter)	Braemar ER910AF event monitor with dry electrode belt; automatic AF detection vs. 24-hr Holter	Cryptogenic Stroke	≥30 s Detected within 90 days	Monitor: 16.1% Holter 3.2
Grond et al.[24] (2013)	Cohort (1172)	72-hr Holter; Lifecard CF (Spacelabs)	Ischemic stroke or TIA	>30 s	4.3% after 72 hr 2.6% after 24 hr
Jabaudon et al.[49] (2004)	Cohort (149)	7-day; R-test Evolution II, (Novacor)	Stroke or TIA	Not stated	ECG: 2.7% 24-hr Holter: 5% ELR: 5.7%[6]
Tung et al.[44] (2014)	Cohort (1171)	14-day continuous ECG monitor (Ziopatch; iRhythm)	Stroke or TIA	>30 s	5%
ASSERT-III[47] (2015)	Cohort (100)	30-day event monitor; automatic AF detection (Vitaphone 3100), wireless central monitoring (m-Health Solutions)	Age≥80 years with hypertension and at least one additional AF risk factor)	≥6 min	15%
SCREEN-AF (NCT02392754)[70]	Ongoing Cohort (1800)	Two 14-day continuous ECG monitors (Ziopatch; iRhythm)	Age≥75 years without prior AF	≥5 min	Ongoing study

EHRA CONSENSUS

Temporal relationship of device-detected atrial fibrillation to thromboembolic events

Year	Trial	Number of patients with TE event	Definition of AF episode	Any AF detected prior to TE event	AF detected only after TE event	No AF in 30 days prior to TE event	Any AF in 30 days prior to TE event
2011	TRENDS[24]	40	5 min	20/40 (50%)	6/40 (15%)	29/40 (73%)	11/40 (27%)
2014	ASSERT[25]	51	6 min	18/51 (35%)	8/51 (16%)	47/51 (92%)	4/51 (8%)
2014	IMPACT AF[26]	69	36/48 atrial beats ≥200 bpm	20/69 (29%)	9/69 (13%)	65/69 (94%)	4/69 (6%)

For patients with two additional CHADS$_2$-VASc risk factors

(ie. >_2 in males, >_3 in females) oral anticoagulation is recommended for

AF burden >5.5 h/day (if there are no contraindications).

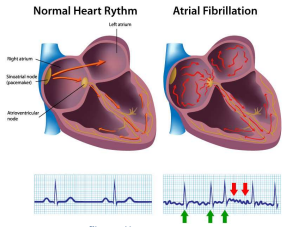
Arrhythmia Burden in Community

- Atrial fibrillation (AF) is the most common cardiac arrhythmia
- It is reported in up to 10.9 % in Irish population > 65 years

(95% of them have higher CV risk for CVAs and anticoagulation is required)

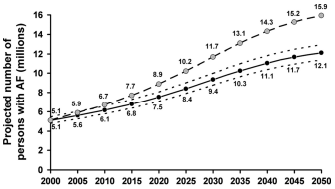
- AF burden is forecasted to be 21.5-27.9 % by 2046 *
- SVT (Include AF) include the following
  - Sinus Tachycardia
  - Inappropriate S Tachycardia
  - Focal AT
  - AVNRT (most common pathology, 60-70 %)
  - AVRT (Accessory pathway, WPW)
  - Atypical AVNRT (5-10%)
  - A Flutter (5-10 %)
  - Junctional /Aautomatic focal AT (5%)

The most common arrhythmia



www.afibmatters.org

Projected number of persons with AF in the United States between 2000 and 2050



Miyasaka Y et al. Circulation. 2006;114:119-125

Recommendations for screening

- Pulse check/ECG over 65 years
- ECG and 72h Holter after TIA/ischemic stroke
- Check ICDs/PMs for high atrial rate episode
- Long-term ECG/loop recorders in stroke patients
- Systematic ECG screening over 75 years

Recommendations for screening for atrial fibrillation

Recommendations	Class[a]	Level[b]	Ref[c]
Opportunistic screening for AF is recommended by pulse taking or ECG rhythm strip in patients >65 years of age.	I	B	130, 134, 155
In patients with TIA or ischaemic stroke, screening for AF is recommended by short-term ECG recording followed by continuous ECG monitoring for at least 72 hours.	I	B	27, 127
It is recommended to interrogate pacemakers and ICDs on a regular basis for atrial high rate episodes (AHRE). Patients with AHRE should undergo further ECG monitoring to document AF before initiating AF therapy.	I	B	141, 156
In stroke patients, additional ECG monitoring by long-term non-invasive ECG monitors or implanted loop recorders should be considered to document silent atrial fibrillation.	IIa	B	18, 128
Systematic ECG screening may be considered to detect AF in patients aged >75 years, or those at high stroke risk.	IIb	B	130, 135, 157

Kirchof et al. Eur Heart J, 2016

Symptoms of atrial fibrillation (AF)

symptoms	women	men	p
currently symptomatic	76%	69%	***
palpitations	54%	47%	***
syncope	4%	4%	*
dyspnea	35%	28%	***
chest pain	18%	15%	**
dizziness	17%	15%	NS
fatigue	28%	26%	NS
previously symptomatic, asymptomatic now	14%	16%	*
never symptomatic	10%	15%	***

Dagres et al. JACC. 2007;49:572-577.

Modified EHRA symptom scale

Modified EHRA score	Symptoms	Description
1	None	AF does not cause any symptoms
2a	Mild	Normal daily activity not affected by symptoms related to AF
2b	Moderate	Normal daily activity not affected by symptoms related to AF, but patient troubled by symptoms[a]
3	Severe	Normal daily activity affected by symptoms related to AF
4	Disabling	Normal daily activity discontinued

Recommendation	Class[a]	Level[b]
Use of the modified EHRA symptom scale is recommended in clinical practice and research studies to quantify AF-related symptoms.	I	C

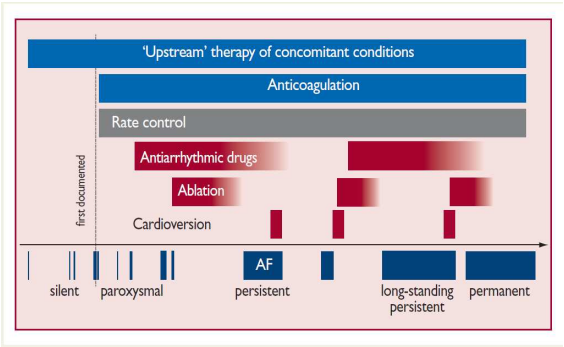
Kirchof et al, Eur Heart J, 2016

Cardiovascular morbidity and mortality associated with AF

Death	increased (especially CV mortality due to sudden death, HF or stroke)
Stroke	20–30% of all strokes are due to AF. A growing number of patients with stroke are diagnosed with 'silent', paroxysmal AF
Hospitalizations	10–40% of AF patients are hospitalized every year
Quality of life	impaired, independent of other cardiovascular conditions
Left ventricular function and heart failure	LV dysfunction is in 20–30% AF causes or aggravates LV dysfunction in many AF patients, while others have completely preserved LV function despite long-standing AF.
Cognitive decline and vascular dementia	cognitive decline and vascular dementia can develop even in anticoagulated AF patients brain white matter lesions are common.

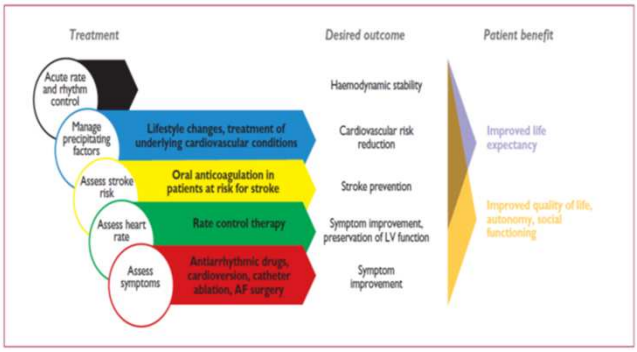
Kirchoff et al. Eur Heart J. 2016.

Natural time course and treatment options



Camm et al. Eur Heart J. 2010;31:2369-2429.

Integrated Management of AF

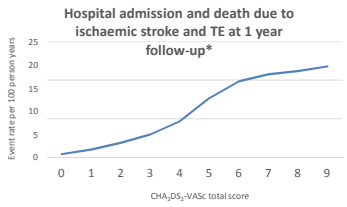


Kirchof et al, Eur Heart J, 2016

Stroke risk assessment with CHA_2DS_2-VASc: Who should we anticoagulate?

CHA_2DS_2-VASc criteria	Score
Congestive heart failure/left ventricular dysfunction	1
Hypertension	1
Age ≥75 years	2
Diabetes mellitus	1
Stroke/transient ischaemic attack/TE	2
Vascular disease (prior MI, peripheral artery disease or aortic plaque)	1
Age 65–74 years	1
Sex category (i.e. female sex=1, male sex=0)	1

Increased CHA_2DS_2-VASc score Indicates a higher stroke risk



Olesen JB, *et al. BMJ* 2011;342:d124.

36

Stroke prevention in patients with atrial fibrillation (1)

Recommendations	Class	Level
Oral anticoagulation therapy to prevent thromboembolism is recommended for all male AF patients with a CHA_2DS_2-VASc score of 2 or more.	I	A
Oral anticoagulation therapy to prevent thromboembolism is recommended in all female AF patients with a CHA_2DS_2-VASc score of 3 or more.	I	A
Oral anticoagulation therapy to prevent thromboembolism should be considered in male AF patients with a CHA_2DS_2-VASc score of 1, considering individual characteristics and patient preferences.	IIa	B
Oral anticoagulation therapy to prevent thromboembolism should be considered in female AF patients with a CHA_2DS_2-VASc score of 2, considering individual characteristics and patient preferences.	IIa	B
Vitamin K antagonist therapy (INR 2.0–3.0 or higher) is recommended for stroke prevention in AF patients with moderate-to-severe mitral stenosis or mechanical heart valves.	I	B
When oral anticoagulation is initiated in a patient with AF who is eligible for a NOAC (apixaban, dabigatran, edoxaban, or rivaroxaban), a NOAC is recommended in preference to a Vitamin K antagonist.	I	A

www.escardio.org/guidelines

European Heart Journal - doi:10.1093/eurheartj/ehw210

Aspirin to prevent AF-related stroke?

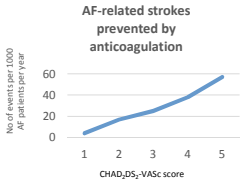
ESC guidelines 2016
Antiplatelet monotherapy is not recommended for stroke prevention in AF patients [1]

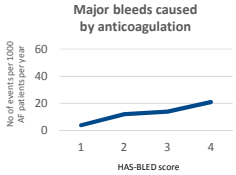
BAFTA study
Anticoagulants are more effective than antiplatelet agents at reducing stroke risk in patients with AF, even in patients aged >75 years [2]

Bleeding risk assessment with HAS-BLED

HAS-BLED risk criteria[1]	Score
Hypertension (uncontrolled, >160 mmHg systolic pressure)	1
Abnormal renal and liver function (1 point each for presence of renal or liver impairment, maximum 2 points)	1 or 2
Stroke (previous history, particularly lacunar)	1
Bleeding (history or predisposition [anaemia])	1
Labile INR (time in therapeutic range <60%)	1
Elderly (i.e. age >65 years)	1
Drugs or alcohol (antiplatelet agents, NSAIDs; 1 point for drugs plus 1 point for alcohol excess, maximum 2 points)	1 or 2

Likely risk/benefit of anticoagulation in patients with AF





NOAC therapy Indications

Contraindications for NOAC therapy

X

- Mechanical prosthetic heart valves
- Moderate to severe mitral stenosis (usually of rheumatic origin)

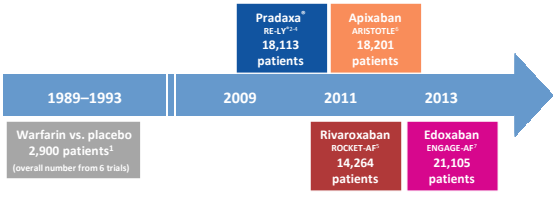
Patients with AF with these conditions are generally excluded from NOAC trials

Eligible for NOAC therapy

✓

- Mild to moderate other native valvular disease
- Severe aortic stenosis*
- Bioprosthetic valve†
- Mitral valve repair‡
- PTAV and TAVI§
- Hypertrophic cardiomyopathy‖

Phase III trial timeline



Overview of Phase III trial specifications

	Pradaxa®[1] RE-LY®	Rivaroxaban[2] ROCKET-AF®	Apixaban[3] ARISTOTLE®	Edoxaban[4] ENGAGE-AF®
Dosing frequency and trial arms	Pradaxa® 150 mg b.d. Pradaxa® 110 mg b.d. Warfarin	Rivaroxaban 20 mg o.d. Warfarin	Apixaban 5 mg b.d. Warfarin	Edoxaban 60 mg o.d. Edoxaban 30 mg o.d. Warfarin
Primary efficacy outcome	Stroke or systemic embolism			
Primary safety outcome	Major bleeding risk	Major and non-major clinically relevant bleeding	Major bleeding risk	Major bleeding risk

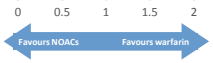
Primary efficacy endpoint: Stroke or systemic embolism with NOACs vs. warfarin

	Hazard Ratio (HR)	NOAC %/year	Warfarin %/year	HR (95% CI)
Pradaxa® 150 mg b.d.[1–3]		1.12	1.72	0.65 (0.52–0.81)
Pradaxa® 110 mg b.d.[1,3]		1.54	1.72	0.89 (0.73–1.09)
Rivaroxaban 20 mg (15 mg*) o.d.[4]		2.10	2.40	0.88 (0.75–1.03)
Apixaban 5 mg (2.5 mg*) b.d.[5]		1.27	1.60	0.79 (0.66–0.95)
Edoxaban 60 mg (30 mg*) o.d. (MITT†)[6]		1.18	1.50	0.79 (0.63–0.99)‡
Edoxaban 60 mg (30 mg*) o.d. (ITT††)[6]		1.57	1.80	0.87 (0.73–1.04)‡

These clinical trials compare each NOAC with warfarin and are not head-to-head comparisons of NOACs

Primary safety endpoint: Major bleeding with NOACs vs. warfarin

	Hazard Ratio (HR)	NOAC %/year	Warfarin %/year	HR (95% CI)
Pradaxa® 150 mg b.d.[1–3]		3.40	3.61	0.94 (0.82–1.08)
Pradaxa® 110 mg b.d.[1,3]		2.92	3.61	0.80 (0.70–0.93)
Rivaroxaban 20 mg (15 mg*) o.d.[4]		3.60	3.40	1.04 (0.90–1.20)
Apixaban 5 mg (2.5 mg*) b.d.[5]		2.13	3.09	0.69 (0.60–0.80)
Edoxaban 60 mg (30 mg*†) o.d.[6]		2.75	3.43	0.80 (0.71–0.91)



These clinical trials compare each NOAC with warfarin and are not head-to-head comparisons of NOACs

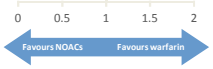
Secondary safety endpoint: Major GI bleeding with NOACs vs. warfarin

	Hazard Ratio (HR)	NOAC %/year	Warfarin %/year	HR (95% CI)
Pradaxa® 150 mg b.d.[1–3]		1.56	1.07	1.48 (1.18–1.85)
Pradaxa® 110 mg b.d.[1,3]		1.15	1.07	1.08 (0.85–1.38)
Rivaroxaban 20 mg (15 mg*) o.d.[4]		2.00	1.24	1.66 (1.34–2.05)
Apixaban 5 mg (2.5 mg*) b.d.[5]		0.76	0.86	0.89 (0.70–1.15)
Edoxaban 60 mg (30 mg*†) o.d.[6]		1.51	1.23	1.23 (1.02–1.50)

These clinical trials compare each NOAC with warfarin and are not head-to-head comparisons of NOACs

Secondary safety endpoint: Intracranial bleeding with NOACs vs. warfarin

	Hazard Ratio (HR)	NOAC %/year	Warfarin %/year	HR (95% CI)
Pradaxa® 150 mg b.d.[1–3]		0.32	0.76	0.41 (0.28–0.60)
Pradaxa® 110 mg b.d.[1,3]		0.23	0.76	0.30 (0.19–0.45)
Rivaroxaban 20 mg (15 mg*) o.d.[4]		0.50	0.70	0.67 (0.47–0.93)
Apixaban 5 mg (2.5 mg*) b.d.[5]		0.33	0.80	0.42 (0.30–0.58)
Edoxaban 60 mg (30 mg*†) o.d.[6]		0.39	0.85	0.47 (0.34–0.63)



These clinical trials compare each NOAC with warfarin and are not head-to-head comparisons of NOACs

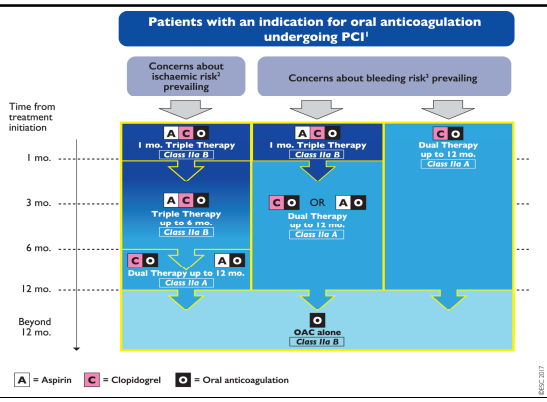
NOAC dosing recommendations

Pradaxa®[1] **150 mg b.d.** **110 mg b.d. in patients:**

– Age ≥80 years

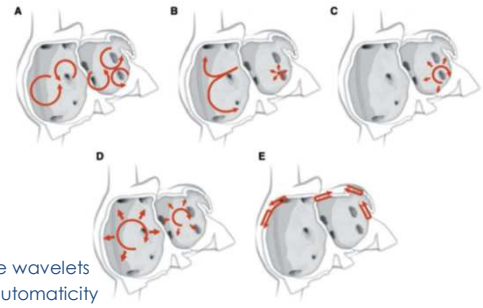
– Concomitant verapamil

Consider dose reduction in other patients at increased risk of bleeding; aged 75-80; moderate renal impairment (CrCl 30–50 mL/min); gastritis, oesophagitis or gastroesophageal reflux



From: 2017 ESC focused update on dual antiplatelet therapy in coronary artery disease developed in collaboration with EACTSThe Task Force for dual antiplatelet therapy in coronary artery disease of the European Society of Cardiology (ESC) and of the European Association for Cardio-Thoracic Surgery (EACTS)

Mechanisms of atrial fibrillation

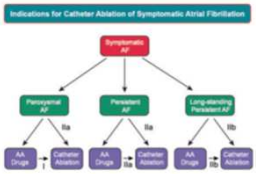


A. multiple wavelets
B. focal automaticity
C. single re-entry with fibrillatory conduction
D. functional re-entry (rotors/spiral waves)
E. endo-epicardial dissociation

Calkins et al, Europace 2018;20:157-208.

Indications of catheter ablation for AF

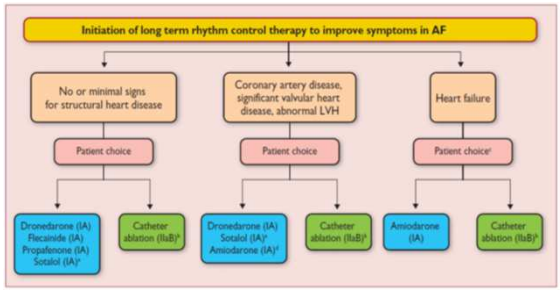
2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus



Recommendation		Class	LOE
Indications for catheter ablation of atrial fibrillation			
A. Indications for catheter ablation of atrial fibrillation			
Symptomatic AF refractory or intolerant to at least one Class I or III antiarrhythmic medication	Paroxysmal: Catheter ablation is recommended.	I	A
	Persistent: Catheter ablation is reasonable.	IIa	B-NR
	Long-standing persistent: Catheter ablation may be considered.	IIb	C-LD
Symptomatic AF prior to initiation of antiarrhythmic therapy with a Class I or III antiarrhythmic medication	Paroxysmal: Catheter ablation is reasonable.	IIa	B-R
	Persistent: Catheter ablation is reasonable.	IIa	C-EO
	Long-standing persistent: Catheter ablation may be considered.	IIb	C-EO

Calkins et al, Europace 2018;20:157-208.

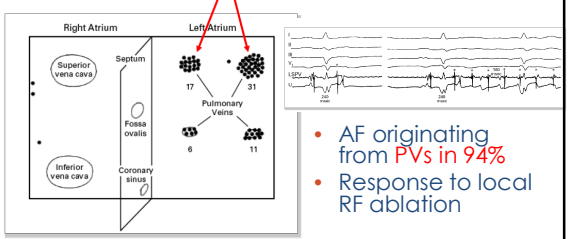
The role of catheter ablation 2016 ESC Guidelines



Kirchof et al, Eur Heart J, 2016

Why pulmonary vein isolation (PVI)?

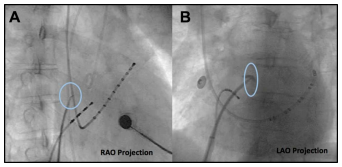
SPONTANEOUS INITIATION OF ATRIAL FIBRILLATION BY ECTOPIC BEATS ORIGINATING IN THE PULMONARY VEINS

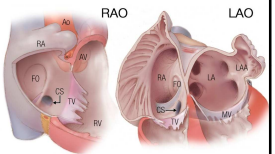


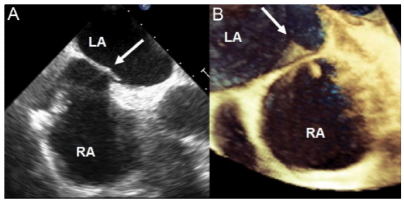
- AF originating from PVs in 94%
- Response to local RF ablation

Haissaguerre et al. NEJM. 1998;339:659-666.

Left atrial access transeptal puncture

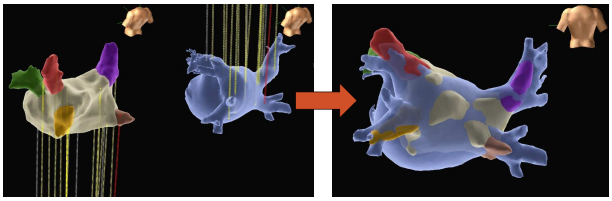






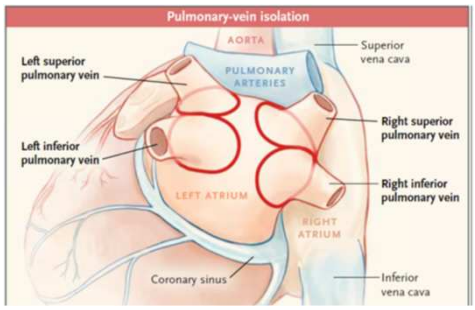
Alkhouli et al. JCIN 2016;9:2465-2480.

Mapping of the LA - integration of pre-acquired CT image



- Dedicated 3D electroanatomical mapping systems
- Reduced ionizing radiation exposure

PVI



Verma et al NEJM 2015;372(19):1812-22

Success rate of catheter ablation

- Catheter ablation 56-89%
- AAD therapy 4-43%
  (Antiarrhythmic drug)

- Definition of success: freedom of AF at 1 year
- low number of patients included: N=30-245
- different ablation techniques
- different monitoring strategies
- different outcomes in paroxysmal vs. persistent AF
- repeat-ablation rate 6-19%

Camm et al. Eur Heart J. 2010;31:2369-2429.

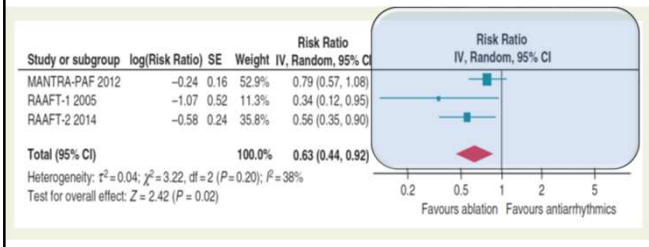
Major complications Worldwide Survey 2003-2006

Type of Complication	No. of Patients	Rate, %
Death	25	0.15
Tamponade	213	1.31
Pneumothorax	15	0.09
Hemothorax	4	0.02
Sepsis, abscesses, or endocarditis	2	0.01
Permanent diaphragmatic paralysis	28	0.17
Total femoral pseudoaneurysm	152	0.93
Total artero-venous fistulae	88	0.54
Valve damage/requiring surgery	11/7	0.07
Atrium-esophageal fistulae	6	0.04
Stroke	37	0.23
Transient ischemic attack	115	0.71
PV stenoses requiring intervention	48	0.29
Total	741	4.54

- 5.9% reported between 1995-2002 (8745 patients)
- 4.54% reported between 2003-2006 (16309 patients)

Cappato et al., Circ Arrhythm Electrophysiol. 2010; 32-38.

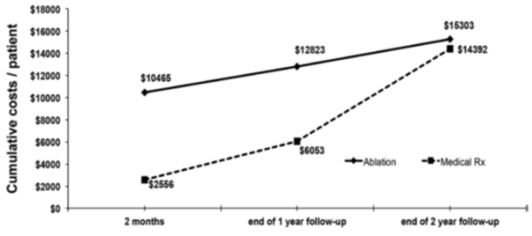
Ablation as first line treatment in Paroxysmal atrial fibrillation



Hakalahti et al., Europace, 2015; 370-378.

Cost effectiveness

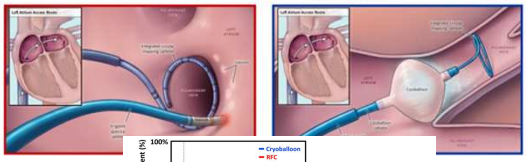
AAD as a first line therapy in paroxysmal AF (RAAFT)

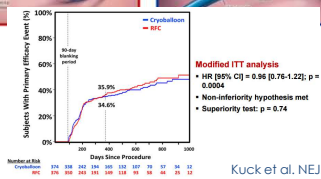


Santangeli et al., Circ Arrhythm Electrophysiol. 2014; 739-746.

The "Fire and Ice Trial"
Cryoballoon as effective as RF ablation

- **RFC Ablation ("FIRE")**
  - Power was not to exceed
    - 40 W at A/I aspect
    - 30 W at P/S aspect
  - 3D electroanatomical mapping
- **Cryoballoon Ablation ("ICE")**
  - Max. freeze duration of 240s recommended
  - Bonus freeze after isolation recommended

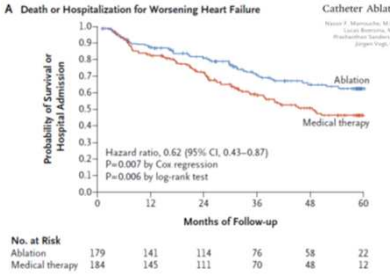




Modified ITT analysis
- HR (95% CI) = 0.96 [0.76-1.22]; p = 0.0004
- Non-inferiority hypothesis met
- Superiority test: p = 0.74

Kuck et al. NEJM, 2016:374(23):2235-45

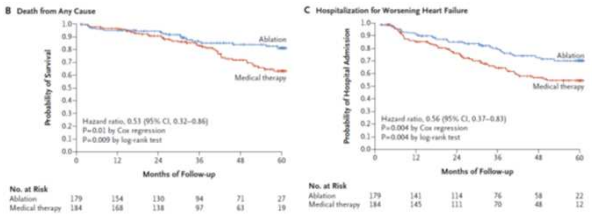
Mortality benefit of AF ablation in HF
CASTLE AF trial - 2017



Catheter Ablation for Atrial Fibrillation with Heart Failure

Marrouche et al. NEJM 2018

Mortality benefit of AF ablation in HF
CASTLE AF trial - 2017

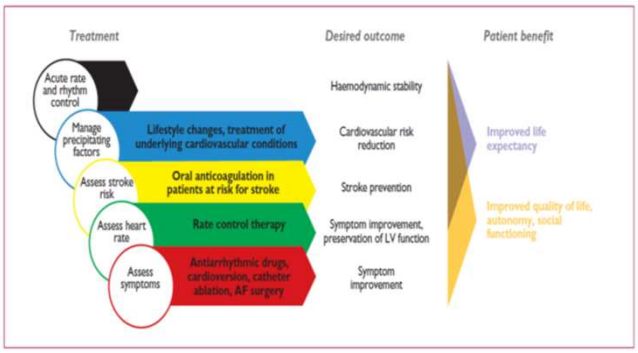


Marrouche et al. NEJM 2018

Catheter ablation of atrial fibrillation in 2018

- Success rates of catheter ablation are improving
- Complication rates are acceptable
- Superiority over AADs in most clinical settings
- Feasible in special patient populations
- Mortality benefit for heart failure patients
- Lack of randomized data on stroke reduction
- No. patients eligible for ablation >>> ablation capacity

Integrated Management of AF



Kirchof et al, Eur Heart J, 2016

Thank you